

ENVIRONMENTAL RESOURCES ASSESSMENT AND MANAGEMENT FOR SUSTAINABLE DEVELOPMENT USING GIS/REMOTE SENSING

J. Kamaruzaman, I.M. Hasmadi, S. Aswati, M. Azian, M.H. Haszuliana, H. Zulhazman, A. Raffae, A.M. Shaiful, C.C. Judibal and M.M. Marghany

Faculty of Forestry
Universiti Putra Malaysia, 43400 UPM, Serdang, Selangor,
Malaysia

Keywords: optical remote sensing, forest survey, prediction, mapping.

Introduction

The challenge for natural resources managers over the next decade is to manage these resources in an economically and ecologically sustainable manner with limited human resource. Remote sensing and Geographical Information Systems are heralded as technology capable of providing improved management solution to this dilemma (Kamaruzaman and Haszuliana, 1996, 1997). Several case studies have been undertaken utilising either one or both technologies to give an insight as to how these technologies may be put to good use in resource planning and management. The general objective of this project is to demonstrate and assess the capability and applicability of both optical and active microwave remotely sensed data to classify, map and manage tropical resources environment utilising several image processing and prediction modelling software. Studies include mapping of land use/cover, agriculture, forest inventory, hazard assessment and prediction.

Materials and Methods

Several optical satellite data were used, namely LANDSAT Thematic Mapper and SPOT. The study area covers the whole of Peninsular Malaysia. Data for most of the studies were processed using integrated remote sensing/GIS software/packages. Standard procedures include spatial and spectral filtering, georeferencing, image to vector digitising, unsupervised and supervised classification, on-site verification, and finally hardcopy outputs. Supervised classification required study areas to be accomplished based on unsupervised classifications and thereafter verified on-site. Confusion matrix was also performed to determine the accuracy of

classification. Final results were produced as hardcopy images on the scale of 1:50 000.

Results and Discussion

With the aid of ground truth data and sound digital image processing techniques, all the optical data used provided sufficient spatial information for mapping/classification accuracy to be in the order of between 82 to 93% (Kamaruzaman and D'Souza, 1996). Such high accuracy are particularly beneficial whereby areas of particular importance and/or land use may be calculated precisely. With georeferenced data/imagery in hand, on-the-ground inventory was also conducted. The application of volume estimation models in the GIS environment and integration with satellite images was able to provide and map total tree volume within a specified area. Such maps and/or data are useful for specific land use planning such as recreation, land/forest rehabilitation, harvesting planning, or proposing other land use, by comprehensively classifying land into zones based on land cover, and resources available.

Conclusions

Studies conducted within this project indicate that remotely sensed data is a useful tool for mapping and monitoring the earth's environment on the whole and of natural resources specifically. Therefore, there is a high potential for satellite remote sensing application in Malaysia, especially with the LANDSAT and SPOT data supported with ancillary data. However, it is emphasised that image processing personnel, i.e. interpreters, have prior knowledge of the study areas before actually beginning with image interpretation.

References

- Kamaruzaman Jusoff and D'Souza, G. 1996. Quantifying Disturbed Hill Dipterocarp Forest Lands in Ulu Tembeling, Malaysia with HRV/SPOT Images. *ISPRS J. Photogrammetry and Remote Sensing*, U. Kingdom. 51: 39-48.
- Kamaruzaman Jusoff and Haszuliana Md. Hassan. 1996. Forest Recreation Planning in Langkawi Island Using Landsat TM. *Int. J. Remote Sensing*, U. Kingdom. 17(8): 3599-3613.
- Kamaruzaman Jusoff and Haszuliana Md. Hassan. 1997. An Overview of Satellite Remote Sensing for Landuse Planning with Special Emphasis in Malaysia. *J. Remote Sensing Reviews*, USA. 16(3/4):1-23.
- Kamaruzaman Jusoff. 1997. Normalized Difference Vegetation Index of Malaysia. *J. Studying the Earth from Space*, Russia. 6: 25-29.